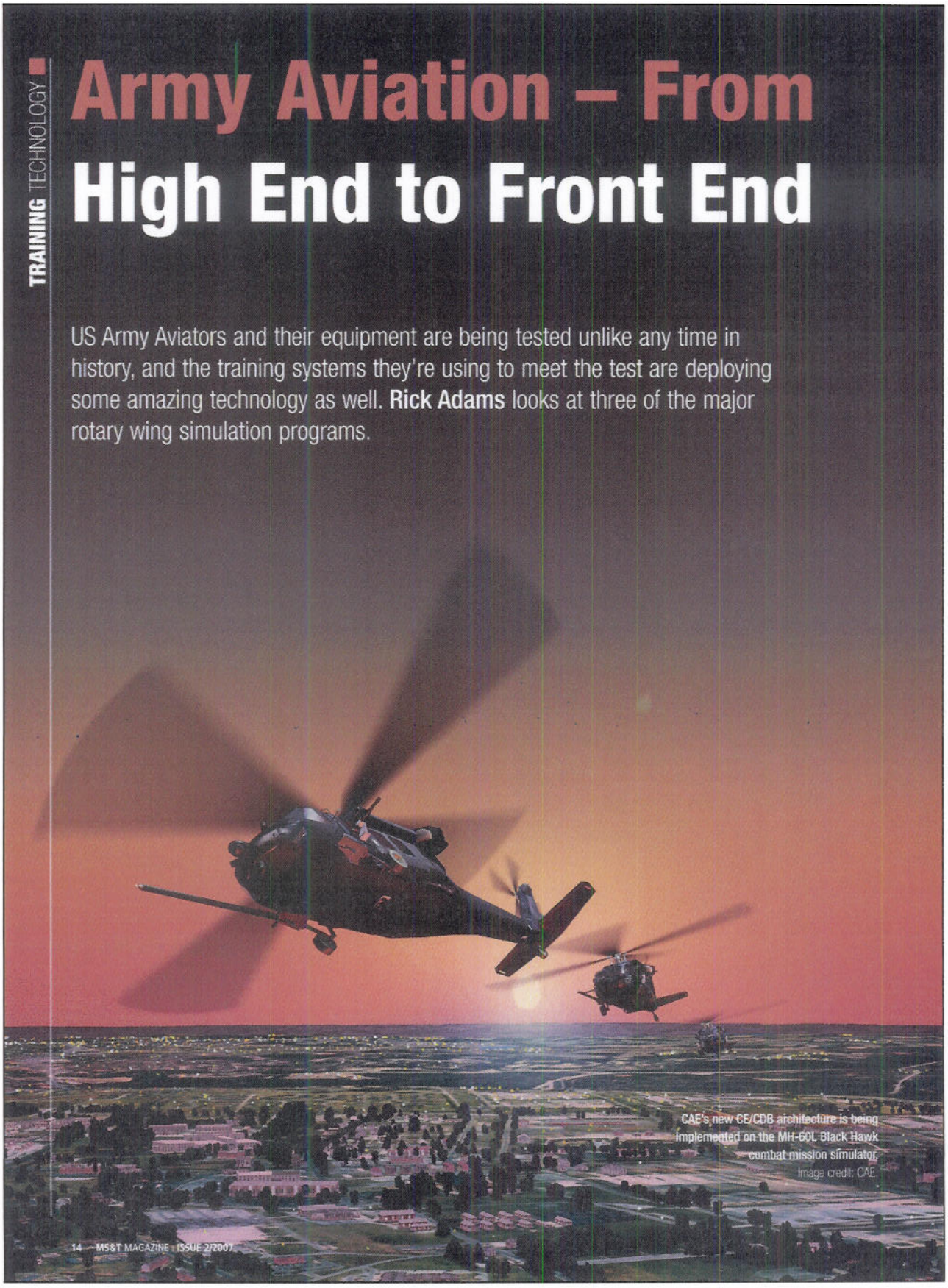
TRAINING TECHNOLOGY

Army Aviation – From High End to Front End

US Army Aviators and their equipment are being tested unlike any time in history, and the training systems they're using to meet the test are deploying some amazing technology as well. **Rick Adams** looks at three of the major rotary wing simulation programs.



CAE's new CE/CDB architecture is being implemented on the MH-60L Black Hawk combat mission simulator. Image credit: CAE

Some aviation experiences last a lifetime in your memory. The thunderous awe of watching, and feeling, the Space Shuttle lift off across the inlet from the close-in VIP viewing stands, engines blazing and smoke billowing on a cool Florida night. The thud of the aircraft's wheels and ultra-quick jolt of catching the third landing wire aboard an aircraft carrier in the middle of the Pacific Ocean. And now I'll add to the list flying in the right seat of the world's most highly sophisticated combat mission simulator for one of the US Special Operations Forces' most advanced fighting aircraft, the MH-47G.

I had the privilege of flying the Chinook CMS with Frank Hazelton, CAE USA's simulation test pilot, at the company's facility in Tampa, Florida, before the device was to be shipped to Fort Campbell, Kentucky. The software load was unclassified, of course, so I didn't get to see all the capability that the US Army's 160th Special Operations Aviation Regiment – Airborne (SOAR(A)) will soon enjoy. But even a glimpse at this trainer's mission muscle is like the ultimate thrill ride for someone who's been observing the development of military flight simulators for nearly a quarter century.

The realism is astonishing. For example, during part of the scenario Hazelton chased down a C-130 refueling aircraft. After all, he explained, crews are sometimes on missions lasting 10 or 12 hours, and aviation fuel only lasts so long. Many pilots, Frank included, make the extremely difficult precision task of air refueling look easy. It's not. You're trying to match the speed of the Herc while riding in his wake, then spear a 'basket' that's drifting all around. There are many forces – two very different aircraft, props, rotors, turbulence, etc. – interacting all at once.

Flight School XXI students are put through a combination of TH-67 aircraft and simulator training before more advanced aircraft.
Image credit: CSC

After we gassed up, Hazelton turned the MH-47G CMS out to sea for a simulated shipboard landing. At one point we spotted a submarine, then lost it as it appeared to submerge. In fact, the sub was still on the surface – it was the huge swells of the ocean that had occluded it from our view as we hovered 50 feet above the water's surface.

The visual realism is courtesy of the CAE-developed common environment/common database (CE/CDB) architecture, which correlates visual, infrared, radar and tactical environment databases used in training and mission rehearsal. The new CE/CDB architecture is being implemented on both the Chinook CMS I rode and an MH-60L Black Hawk CMS, also under development by CAE USA. Both the database and CMS contracts were let by the US Army's Program Executive Office for Simulation, Training & Instrumentation (PEO STRI) in Orlando, Florida.

David Graham, CAE's director for Special Operations Forces programs, described the common database's terrain and imagery resolution as "near-infinite" (13 microns) and "near-infinite scalability" – up to 100 million features of cultural density and a database size limited only by storage capacity. "The same database supports very high-performance computer-generated forces, high performance multi-mode radar, high-performance communication simulation, high-performance navigation simulation … all simulation 'clients' that need the synthetic view of the dirt." Or water, as the case may be.

More particularly, considering the unique insertion/extraction missions of the SOAR, the

system is "organized for rapid change and small area updates within a worldwide database," Graham adds.

Like most memorable experiences, the combat mission simulator flight seemed all too brief. The CAE engineers were ready for some additional fine tuning before handover to the customer, so Frank set her down on the aircraft carrier bobbing up and down below the chin windows. Barely felt the skids touch.

Flight School XXI

At the other end of the training spectrum, Flight School XXI has the primary task of teaching pilot wanna-bes the fundamentals of rotary wing visual and instrument flight. CSC is the prime contractor for the nearly 20-year, US$1 billion turnkey simulator service awarded by PEO-STRI in 2003.

Flying candidates typically enter the FS XXI schoolhouse with little or no aviation experience, according to David Lofton, CSC's deputy program manager. The Army pairs up two students to each contractor instructor (provided by Lear Siegler Services) to put them through the paces of first, a combination of TH-67 aircraft and simulator training, then, if they succeed, to more advanced aircraft such as Black Hawk, Chinook, Apache, and Kiowa Warrior.

Many of the students fly combat missions less than a month after graduating from flight school.

In addition to initial entry rotary wing candidates, the CSC simulator suites are used by the Army for very intensive 6- to 10-day mission-oriented training for units preparing to deploy to a "focused contingency area," ie, Iraq or Afghanistan. "We develop a complete training support plan for the units", Lofton explains, "including all the necessary intelligence and operational background, together with a series of orders. They go through the entire sequence of planning and preparation, execution, reaction to changes, and debrief. The mission parameters are very much real-world."

FS XXI is housed in two facilities at Fort Rucker, Alabama -- in the Aviation Warfighter Simulation Center and Warrior Hall, a new 136,000-square-foot facility. CSC is responsible for all aspects of the facility from building security to simulator and facility operations and maintenance.

Warrior Hall houses 38 simulators, a combination of operational flight trainers (OFTs) and instrument flight trainers (IFTs) all of which were newly developed based on training tasks laid out in the Army's requirement. "They are custom-built devices to fit a specific training need," notes Lofton.

FlightSafety International produced the TH-67 Creek OFTs and IFTs, extracting data from their commercial Bell JetRanger experience.

L-3's Link Simulation & Training is responsible for the suites of Advanced Aircraft Virtual Simulators (AAVS) -- eight UH-60A/L OFTs, three UH-60A/L IFTs, three CH-47D OFTs, two OH-58D OFTs, and one AH-64D OFT.

Link is also putting the finishing touches on two OH-58D Kiowa Warrior simulators, "something the Army has never had before," Lofton points out. CSC expects customer accreditation within the next month or two.

All of the OFTs have fully electric motion platforms. Currently seven of the 20 TH-67s are IFTs mounted on stilts, which Lofton says will enable them to be converted to full-motion trainers, if the need arises, without having to jack up the cockpit.

Link has also delivered 18 reconfigurable collective training devices (RCTDs) that can communicate with each other and be transformed within an hour into specific aircraft types via swap-out panels and software. RCTDs also are used for professional military education, such as the captain's career course, the officer basic course and the officer advanced course.

The visual system on the TH-67 devices is an FSI Vital 9. The AAVS units feature a CATI X-IG image generator, and the RCTDs use a Link SimuView PC-based visual. However, all three draw from a common open-flight database to create the run-time out-the-window and sensor imagery.

Dale Dew, CSC's chief engineer on the program, says what the pilots see -- whether of the area surrounding Fort Rucker or deployment areas -- is very robust and realistic. The FS XXI program has its own database modeling capability "with access to some really high-detail satellite imagery." Dew explains, "We are trying to get as close to real-time data as possible to model the areas of interest."

Dew also cites FS XXI's after action/debrief facilities as offering extensive review capability: out-the-window replay, sensor views, radio and comms traffic, instrument tracks, stealth views from outside the aircraft, forces maps. For large groups, there's a 300-seat conference center; instructors can also debrief one or two students.

One of the toughest challenges, according to Lofton, is keeping the simulators concurrent with changes to the aircraft (has there ever been a simulator program without this issue?). "Getting everybody in sync -- the government, the aircraft manufacturer, and the subcontractors -- requires very intensive management ... all day, every day."

The students themselves, together with the instructor cadre, present one of the other aspects that keep CSC on its toes. "They have very high standards, and in moving back and forth between simulator and aircraft, they are often comparing tasks in the aircraft to the performance in the simulator."

Currently, the student throughput is about 1200 initial entry pilots per year. Another 1600 or so do some training on the advanced devices, including aircraft type rating upgrades.

AVCATT

L-3/Link is the main device provider and system integrator for the AVCATT (Army Aviation Combined Arms Tactical Trainer) program, now about two-thirds of the way through its delivery of training suites.

Link was awarded a $51.1 million follow-on production contract to build five additional AVCATT suites -- numbers 16 through 20. Four suites are destined for US Army Reserve Component training sites, beginning this December, with the fifth to be delivered to a joint-use active Army/Reserve Component installation.

Each AVCATT suite consists of two mobile 53-foot trailers that house six reconfigurable simulators, a battle master control room, and an after-action review theater. The simulators can be reconfigured to represent any combination of AH-64D Longbow, AH-64A, OH-58D, UH-60A/L and CH-47D platforms.

Gary Kolman, Link's AVCATT program director, says that in addition to production deliveries there's been plenty of upgrade activity. For example, copilot/gunners in some aircraft no longer have to struggle with a small 3-inch-square screen for sighting; it's been replaced with an 8x8 display with

much higher resolution for Day TV and FLIR effects. Multi-function displays on the Apache Longbow and Kiowa Warrior configurations, which had been rear-projected through panels which could be rapidly changed out, have been replaced with MFD liquid crystal display hardware that looks more like the real aircraft. "Those aircraft fight from the MFDs, more so than some of the others. The MFDs present a lot of information about the tactical situation. This upgrade displays symbology with greater clarity."

A simulator-specific enhancement to the communications system, provided by ASTI, will also generate increased capability for aural cues such as the directionality sounds of bullets whizzing past or impacting the aircraft.

In the future, the AVCATT program will incorporate the Rockwell Collins common avionics architecture system (CAAS) on aircraft such as the CH-47F and UH-60M.

These days, of course, you can't field a military trainer without interoperability hooks for other trainers. The AVCATT devices have long been married up with Close Combat Tactical Trainer (CCTT) suites, initially on a base by base basis, later involving long-haul networking between Fort Rucker and home stations. Now, Kolman, notes, the Army is linking Rucker AVCATT modules with Fort Benning ground forces and call-for-fire trainers for some advanced officer courses. There has also been some proof of principle interoperability with virtual convoy trainers developed by Lockheed Martin and Raydon.

AVCATTs have even played in scenarios with unmanned aerial vehicle (UAV) simulators that weren't necessarily designed to log into the distributed training network, but hey, they're part of the battlefield package, right?

The aviation trainers will also begin receiving some of the new OneSAF semi-automated forces capability in the coming months. PEO-STRI has dispatched software distribution teams to several sites, including Fort Rucker, to teach "OneSAF 101" on how to install and run specific admin functions, set up for distributed networks, and "how to get in there and start manipulating the system," according to Lt. Col. Rob Rasch, the Army's product manager. "The goal at the end of two weeks is to run OneSAF off the site's software. We have a culminating event, a battalion-level scenario, so they can apply what they have learned and fight the fight."

Kolman says the Link team will target specific functionalities this year, using a sort of hybrid between 'AVCATT SAF' and the SAIC-developed OneSAF objective system.

Commanders direct the wizardry of friendlies and OpFors, degraded comms, inclement weather effects and other realistic effects from a battle master control station in one of the trailers. A quartet of role player stations enable live individuals to serve as artillery, joint air support, ground, engineer or logistics force commanders. MST